

# SOIL CONSERVATION

CLAUDE R. WICKARD  
*Secretary of Agriculture*

HUGH H. BENNETT  
*Chief, Soil Conservation Service*

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## DISTRICT GIVES BLOW LAND NEW 95-YEAR LEASE ON LIFE

BY A. M. HEDGE<sup>1</sup>

AN HISTORIC step has been taken by directors of the West Ottawa Soil Conservation District in placing 1,436 acres of tax-reverted lands under a long-term, systematic plan of conservation and management. Land was leased by the district after it had been transferred to the county under Michigan's tax reversion act.

Like many other States, Michigan has been plagued for years with the perennial problem of what to do with tax-delinquent lands. Efforts to sell these lands for back taxes and penalties were fruitless in many instances because no bidders wanted the lands. Where such sales were made, to bidders who were interested, the new owners were no more able to make a living and pay taxes than the folks who had just lost the farms. Thus it turned out that the counties were faced with periodic tax sales on the same farms every few years, and the land meantime was becoming ever more useless because of mismanagement and abuse.

In 1937 the tax laws of the State were amended to provide that land that is tax delinquent for 3 years will automatically revert to the State. The owner is given an additional year in which to redeem his title by paying the taxes and penalties. Land that is not redeemed is handled in one of two ways, depending on its location in the State. North of a line approximating Town Line 40, and roughly separating the cut-over area from the agricultural and industrial part of the State, all reverted lands are placed under the jurisdiction of the State Department of Conservation. South of this line reverted lands are handled by a State real estate board created by the law. Ottawa County lies south of Town Line 40, and is in the area that comes under the jurisdiction of the real estate board.

<sup>1</sup> Chief, regional division of land management and institutional adjustments, Ohio Valley Region, Soil Conservation Service, Dayton, Ohio.

The State tax law provides that the real-estate board shall advertise and sell lands certified as tax delinquent, to the highest bidder, provided the bid is enough to cover the back taxes and penalties. Lands that cannot be thus disposed of are appraised by the board and may be sold for the amount of these appraisals. If bids are not equal to the appraisal, the board may give title to any political subdivision of the State requesting the lands.

That is how Ottawa County recently came into possession of 1,436 acres. The law specifies that political subdivisions receiving land in this manner must dedicate it to public uses for a period of 10 years. The problem was one, therefore, of securing for this land an assured plan of conservation management over a long period of time and of guaranteeing, insofar as possible, that the management in future years would not permit conditions to recede to the status that caused the parcels to go tax delinquent.

To meet this problem the county supervisors decided to lease the land to the board of directors of the West Ottawa Soil Conservation District for an initial period of 50 years, with automatic renewal privileges for three periods of 15 years each, making a total of 95 years if the lease runs its course. Under the terms of this lease the district pays the county \$1 rental.

The district assumes full responsibility for development, improvement, protection and management of the land, collects all revenues and pays all expenses, causes a long-time plan of development and management to be prepared which must be approved by the county supervisors and the director of the State Department of Conservation before it is initiated. The county supervisors agree to cooperate in effectuating

# CLIMATE OF THE SOUTHWEST IN RELATION TO ACCELERATED EROSION

BY C. W. THORNTHWAITTE, C. F. S. SHARPE, AND EARL F. DOSCH<sup>1</sup>

FOR two generations, or since about 1885, destructive changes in the land surface in the Southwest have become increasingly apparent. Broad flat-floored valleys have been dissected by deep gullies and the resulting lowering of the water table has diminished the vegetation of the valley bottoms. Trampling and heavy grazing by large herds have greatly reduced the available forage. Ranges that once carried 10,000 head of cattle now can scarcely support one-quarter as many, and valleys that the first white settlers converted into prosperous farms are now deeply cut badlands unsuitable even for grazing.

If, as some workers believe, the dissection of these lands of the Southwest has been brought about by a progressive change to more arid climate it is questionable whether man can effectively stop the accelerated erosion. If, as others are convinced, misuse of the land by overgrazing and imprudent methods of agriculture has been the cause it is quite possible that the land can be improved by improving the use. The evidence underlying these divergent points of view has been examined in considerable detail in a study now in press<sup>2</sup> and the conclusion was reached that the latter view has more to recommend it.

Variability is an outstanding characteristic of climate. Nowhere is the climate of one year just like that of the next. In much of the United States, the variation from year to year, although large, does not endanger the existing land-use economy. But in the Southwest the margin of available moisture is so small that even a slight fluctuation in climate may bring drastic reductions in plant cover. Climatic fluctuations are made up of variations in the several climatic elements of which precipitation and temperature are the most important.

The climatic pattern in the Southwest, and the shifts in climatic zones from year to year, are explained by the atmospheric circulation. The diurnal and annual marches of temperature and precipitation caused by the relation of the earth to the sun are complicated by fluctuations resulting from the invasion and interaction of the various air masses that enter the Southwest. These masses are cool and moist,

cool and dry, warm and moist, or warm and dry, depending on the source region from which they come and the route followed (fig. 1). They cause the day-to-day and week-to-week changes in temperature and precipitation (fig. 2). They determine the presence or absence of rain, and the size, shape, internal structure, position, and migration pattern of the individual rainstorm. The almost infinite number of possible sequences of air masses from first one and then another direction, each varying in moisture content and other properties, and an equally large diversity of interactions between air masses, some making for rain and others tending to prevent it altogether for long periods, account for the fluctuations in precipitation and temperature experienced in the Southwest.

Year-to-year variations in precipitation and temperature result in marked shifts in the climatic pattern. An area that in most years is semiarid may be arid

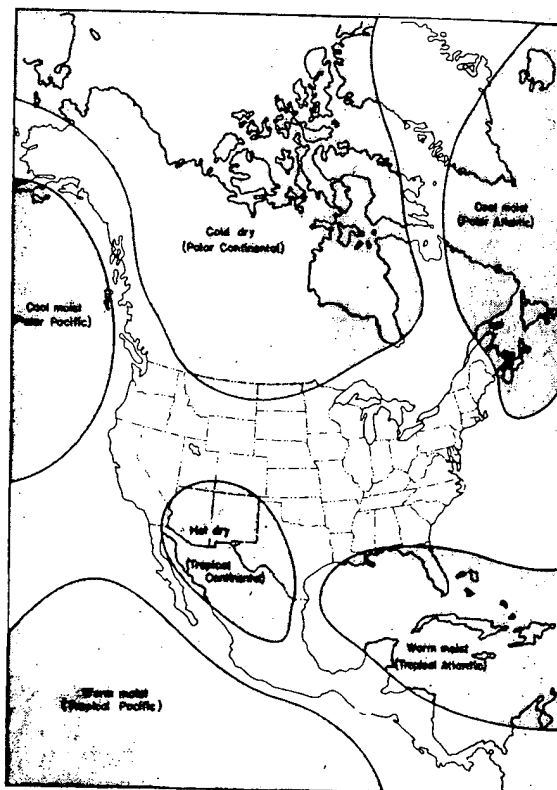


Figure 1. Air masses invading the Southwest may be cool and moist, cool and dry, warm and moist, or warm and dry, depending on the source region from which they come.

<sup>1</sup> Chief, associate soil conservationist, and assistant soil conservationist, respectively, Climatic and Physiographic Division, Office of Research, Soil Conservation Service, Washington, D. C.

<sup>2</sup> C. W. Thornthwaite, C. F. S. Sharpe, and E. F. Dosch; Climate and Accelerated Erosion in the Southwest with Special Reference to the Pinal Wash Drainage Basin, Arizona. U. S. Department of Agriculture Technical Bulletin. (In press.)

random interactions of air masses. If there has been any progressive climatic change in either direction it is so small as to be completely overshadowed by these fluctuations.

In recent years the science of dendrochronology, developed in the Southwest by Prof. A. E. Douglass and his students, has accumulated evidence which has been used variously to prove and disprove the existence of climatic change. A statement made only a few months ago by one of the students of tree rings shows that they are indicative of climatic fluctuations rather than climatic changes (8, pp. 67-68).

Lake levels in the Great Basin have constantly risen and fallen and have been studied for evidence of climatic fluctuations and progressive changes. According to Antevs (11, p. 71) the expansion of the Pleistocene lakes in the Great Basin corresponded to the maximum extension of glaciers in the neighboring mountain ranges and of ice sheets over the northern part of the continent. He places the last major lake expansion at 30,000 to 35,000 years ago. The well-developed shore lines and the lack of deltas indicate that diminished evaporation rather than increased precipitation and run-off was the main factor in the rise of lake levels. That large changes of lake levels in the Great Basin during the last century are associated with upward and downward fluctuations of precipitation is shown by rainfall data supplemented by tree-ring records (2).

Archaeological evidence, cited by Powell in 1898, indicates that the Pueblo cultures of the Southwest were developed under conditions approximately as adverse as they are at present (12, p. lxvii).

In recent years, Kirk Bryan and his students have presented a tremendous array of physiographic observations as evidence of climatic change. Detailed studies have been made in many valleys of the Southwest that appear to have been filled and evacuated several times in the past. Buried channels upward of one-third mile in length have been traced in the filled valleys of New Mexico (3, 4). In the Jadito, Oraibi, and other valleys in Arizona, Hack (6) has found remnants of several terraces or benches, each associated with distinctive fill material, which contain buried arroyo channels. These he interprets to be evidence of three stages of filling and three of cutting since the original carving of the valleys. Describing a series of valley fills in the Davis Mountains, Trans-Pecos, Tex., Albritton and Bryan (1, p. 1472) say:

It is a well-established working hypothesis that in an arid climate and in areas of ephemeral and intermittent streams aggradation of valley floors occurs in periods of relative humidity and erosion by channeling occurs in periods of relative aridity.

On a table giving a tentative correlation of the stages of filling and eroding in valleys of western Texas with those of the Jadito Wash, Ariz., described by Hack, each period of aggradation is indicated as "more humid" and each time of erosion, represented in the sedimentary record by disconformities, is shown as "less humid" (1, p. 1468). It is worth noting that Huntington (10, pp. 31-36) also attributes alternate filling and cutting in the valleys of the Southwest to climatic change, but he believes that aggradation is due to greater aridity and cutting to increased rain fall.

These physiographic observations and their interpretation in terms of climatic change are of much more than academic interest because they have led Bryan to attribute the recent acceleration of erosion in the Southwest to progressive desiccation. He believes that channel trenching was independent of settlement and its attendant overgrazing although the two happened to be contemporaneous. In a recent address,<sup>3</sup> Bryan concluded that the channeling was imminent at the time when cattle were introduced into the country and the coincidence in time between the introduction of the cattle and the cutting of the channels was the same coincidence as that between the pulling of a trigger and the explosion of the cartridge. This comparison was used again in a paper published only a short time ago (5).

#### Processes of Erosion in the Southwest

Consideration of the processes at work in the valleys of the Southwest will show that neither buried channels nor valley terraces and fills constitute evidence of regional change from erosion by channeling to aggradation of valley floors and back again. Furthermore, the channeling and other features of the valley fill cannot be adequately explained as a result of regional changes in erosion and deposition.

Under natural conditions few of the valleys of the semiarid and arid regions contained perennial streams or even continuous channels down the drainageways. Arroyos were cut locally as a result of heavy showers and the material removed was carried only a short distance down valley and deposited as a fan. The growth of discontinuous arroyos was much like that of the discontinuous gullies formed in many of the valleys in recent years by accelerated erosion. Before the formation of a continuous medial gully down the length of a valley such as the Oraibi, Polacca, or Jadito, in northeastern Arizona, rain falling in one part of a drainage might be felt as run-off for a few miles or tens of miles down valley, but the flow

<sup>3</sup> Great Plains Conference, Flagstaff, Ariz., September 3, 1939

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Figure 3. In 1905 an unusually large area of the Southwest had humid climate and almost none was arid. In 1934 none of the region was humid or even moist-subhumid. Arid climate was widespread.

seldom traveled much farther. Reaches of arroyo cutting alternated with reaches of deposition. In times of normal precipitation, arroyos lengthened upstream by headward erosion and at their lower ends became choked and buried by their own debris. Where a series of discontinuous channels was developed down a drainageway the head of each arroyo might cut into the alluvial fan being built by the next arroyo up valley.

Deposition at the lower ends of arroyos by back-filling of the channels (7, p. 29) produced waves of sedimentation that migrated up valley. Material removed from the head of the arroyo was transported downstream a few feet or a few miles and deposited. Although the sediment load moved down valley, the individual deposits were enlarged by addition to their up-valley ends, resulting in the upward migration of each locus of sedimentation.

During floods resulting from occasional intense precipitation the flow carried farther than usual. Channels were cleared out and fans were dissected.

Dropping of the sediment load formed a down-valley extension of the fan, or, if the lengthened channel intersected another channel down drainage, the load might be carried much farther to form a new fan. Especially in these longer channels, persistent down-valley migration of bends and meanders greatly increased channel width and in time could even cut out an entire valley fill. Excessive run-off from heavy rains, then, by cutting out of older fills caused a down-valley migration of the locus of sedimentation.

Prior to the beginning of accelerated erosion in the Polacca Wash in northern Arizona, five large discontinuous channels were cutting out fill in separate reaches of the valley and depositing it again in fan zones immediately below. With five waves of erosion and five corresponding waves of sedimentation migrating up valley simultaneously, it is obvious that at any one place erosion and aggradation would follow each other consecutively. Each fill would vary greatly in age from one part of the valley to another, depending on the time required for a sediment wave to migrate from end to end of the valley. In regions of semiarid and arid climate neither erosion nor deposition can go on exclusively throughout an entire drainage basin. Rainstorms are local and run-off diminishes rapidly beyond the limits of the storm area. Material picked up by the flowing water will soon be deposited.

The normal processes of erosion and sedimentation, some of which are outlined above, are adequate to produce successive filling and cutting of various parts of valleys without any change of climate. Complex interactions of the up-valley and down-valley waves of sedimentation offer an almost infinite variety of fill sequences. The complicated sedimentary history of many of the valleys in the Southwest is not fully revealed by the few exposures on gully walls, but even so, it is clear that the explanation of successive deposition and removal of fill lies in sedimentary processes and irregular occurrence of heavy storms rather than in any change of climate.

That a land surface which has been irritated by overgrazing and cut by stock and wagon trails will be gullied by a less intense rainstorm than will a surface in its natural condition is well recognized. It is difficult, therefore, to see any reasonable basis for Bryan's claim that overgrazing simply touched off a cycle of accelerated erosion and that gully cutting might have been initiated in the Southwest by 1940 or 1950 even had the country never been settled or used for range.<sup>4</sup> Acceleration of erosion in semiarid areas where the

<sup>4</sup> Great Plains Conference, Flagstaff, Ariz., September 3, 1939.

plant cover has not been depleted by overgrazing or where there has been no other form of irritation of the surface is entirely possible, and it has certainly occurred from time to time in the past. However, under natural conditions the protection against erosion afforded by the vegetation and by the soil mantle itself is sufficient for all except the most intense rainstorms. Most of the storms that contributed to the extensive gulying of the last half-century would have done little or no damage had the surface remained in its natural condition. Rainstorms of sufficient intensity to produce erosion on a surface possessing its natural protective cover are far less likely to occur than the moderately intense rains that brought about the existing gulying.

The accelerated erosion that is damaging the lands in the Southwest appears then to have been brought on by man, and by proper methods man can check the erosion and reclaim the land for his use. Mechanical

aids such as diversion dams, distribution ditches, and spreader structures, modernized since the days they were first applied by the Hopis and other agricultural Indians, can be used to keep water out of the gully and spread it on the valley lands where it can be utilized. The major dependence, however, must be placed on a plant cover adequate to protect the soil against the occasional heavy rains. Because of climatic fluctuations this project will be more difficult in certain years than in others. Some years will have greater than average precipitation, some less. Wet year may follow wet year, or drought year may follow drought year in long series. Individual months will be exceptionally wet or dry, hot or cold. Occasional intense storms will deluge the land and, depending on the completeness of the plant cover at the time, may drain away with little erosive effect or may carve new channelways and enlarge old ones.

(Continued on p. 304)

## FROM AN ARKANSAS DISTRICT REPORT

Excerpts from a semiannual report made by the supervisors of the Central Crowley Ridge Soil Conservation District, Arkansas, for the period ending June 30, 1940:

In organizing the work for the district the supervisors set up six priority areas in the district and had these priority areas mapped solid. From the interest shown in the educational meetings conducted by the supervisors, assisted by the extension service, a concerted effort was made to secure applications from every land owner in these areas so planning and execution could be done with groups rather than with so many individuals. The wisdom of this policy was shown in the first area mapped. This area was small—only 27 farms—but of the 27 mapped, 25 became co-operators, one was already cooperating with the Jonesboro SCS Camp, which left only one out of 27 not signed to cooperative agreements. This one farm is owned by an absentee landlord. In other areas the solidarity of planning has been almost as successful. 201 district agreements have been signed, all in the six priority areas. The supervisors believe this policy reduces transportation, saves time of the planning technicians, makes possible more and better execution, but above all,

it is felt that a more effective conservation program is possible through group action.

Craighead County has been designated as one of the counties in Arkansas for county-wide planning by farmer committees assisted by representatives from various bureaus of the Department of Agriculture. This work has been proceeding for some time. The preliminary report has been prepared. It is worthy of note that the recommendations made by the county planning committee for the part of county embraced in the district coincides with the program and work plan of the district. It is felt that the work of the county planning committee will further the district program for conservation very materially.

Arkansas State College, which is located within the district, is cooperating in a conservation program on the college farm. In addition to this, more emphasis is being placed upon agriculture and conservation in the curricula. Courses in conservation are being given and the college students taking these courses have made use of farms under treatment for laboratory and field studies. Members of the district personnel, upon request from the college authorities, have appeared as guest instructors before the classes studying conservation.